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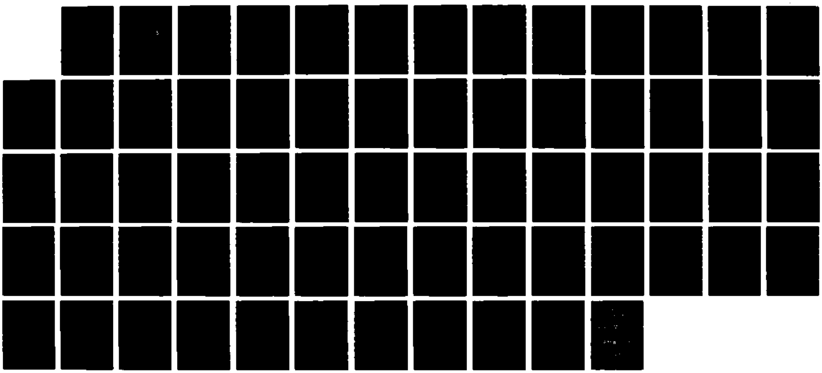

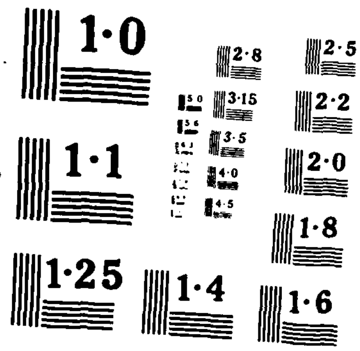
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AN ANALYSIS OF PIECE PART COMMONALITY

IN AN AIRCRAFT AVIONICS SYSTEM

THESIS

Geoffrey E. Tasker
Squadron Leader, RAAF

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AN ANALYSIS OF PIECE PART COMMONALITY IN AN AIRCRAFT AVIONICS SYSTEM

THESIS

Presented to the Faculty of the School of Systems and Logistics

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the

Requirements for the Degree of

Master of Science in Logistics Management

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Squadron Leader, RAAF

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Preface

The purpose of this study has been to demonstrate that worthwhile cost savings can be gained by considering commonality of components in a new avionics system purchase. Although the analysis is specifically concerned with avionics systems, the results and recommended procurement policy changes can be generalized to include all types of new systems.

Because Economic Order Quantity information was not available for the system analyzed, the savings shown are not as large as what could be achieved in reality. Despite this inexplicit determination, the results demonstrate that the savings available are considerable.

While undertaking and completing this thesis I have received a great deal of support, assistance, and help from others. My main thanks go to Flight Lieutenant Arnie Vereschildt, who despite the pressures of his own work, has always found the time to explain the necessary details to me, or to search out the information in Australia that I could not get access to from the USA. I also wish to thank my thesis advisor Major P. E. Miller for his patience and cooperation throughout this study. Finally, I wish to thank my family, especially my wife Helen, for their understanding through all of those nights and days when we all wanted to have more time together.

Geoffrey E. Tasker

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Abstract

The purpose of this study was to determine if worthwhile cost savings could be obtained by the Royal Australian Air Force by considering commonality of piece part components during the acquisition of a new aircraft avionics system. The study had two basic objectives: (1) Determine if common component procurement could be reduced during a new system acquisition, and thus provide cost savings for the RAAF. (2) Determine a method that would allow a comparison to be made, between the savings gained and aircraft availability lost, as a result of not procuring unique components associated with the new system.

The study found that considerable immediate and long term cost savings could be obtained if the procurement policy was changed so that only essential common components were purchased. It was recommended that common components be purchased coincident with the new system only when the subsequent demand rate would exceed the inventory holdings.

A simple mathematical model was developed in this study that allows the determination of the effect of not procuring unique components on aircraft operational availability. The study recommends that future procurements use this model and then, on an individual project or system basis, compare the potential cost savings with the expected reduction in aircraft availability, to determine the level or number of unique components procured with the new system.

AN ANALYSIS OF PIECE PART COMMONALITY

IN AN AIRCRAFT AVIONICS SYSTEM

I. Introduction

Overview

This chapter contains a general background on the Royal Australian Air Force (RAAF) avionics procurement methods, and discusses why it is important for the RAAF to consider commonality of sub-components. The problems addressed by this research effort and the research objectives are stated. Also included are the assumptions, limitations and scope of the study.

Background

Because of necessary budgetary constraints, a government's decision to purchase an item of military equipment should include consideration of all associated costs, aiming to reduce them to a minimum without detracting from the proposed acquisition or degrading the systems performance.

A necessary element of any equipment acquisition is the assessment, ordering, procurement, and maintenance of spare parts required through the expected life of the equipment (4:245). The Australian government, with its somewhat limited military budget, must ensure that there is an accurate assessment of these required spare parts. The RAAF

should take into account possible methods of reducing or eliminating any unnecessary acquisition and spending on spares.

Avionics are items of electronic equipment used on board an aircraft and would include such items as radios, navigation equipment, and radar. Most of the Australian government's avionic equipment is purchased from overseas, and then mainly from the United States of America (USA) (2).

Because these avionics are not procured from within Australia, thereby increasing the logistic supply link distance, the RAAF has deemed it important that apart from piece parts, all of the spares required for the expected life of the system be procured during the system acquisition phase, and that the acquired system must be fully repairable at base or depot level, preferably base level (10).

The current RAAF policy for acquisition uses the top three levels of the four level avionics system hierarchy (14). The system hierarchy is a systematic breakdown of its elements into the lower elements, and for the purpose of this study, the avionics hierarchy is composed of:

1. systems (for example a radio set);
2. sub-systems (an example being a power supply);
3. sub-components (for example a power amplification circuit board); and
4. the piece part level (for example, a resistor or integrated circuit).

There are two phases of spare parts acquisition for any system, including avionics, that are currently not integrated. The first is the spares purchased with the initial avionics system buy, and the second is the annual procurement of spares assessed as required for the forthcoming years, and determined in the procurement cycle. The RAAF only considers the avionic system, sub-system, and subcomponents as inputs to the model for initial acquisition. For the annual assessment of spares provisioning carried out, all four levels are input to the computer model (12),(14). The current piece part assessment of spare parts, for an initial acquisition, requires 1.2 man hours per individual piece part (16). For an average system comprising 1500 piece parts, this assessment would require 1800 man hours and would take two people approximately six months to complete.

To overcome this large waste of manpower, the RAAF policy has dictated that the appropriate project assessor is empowered to make a unilateral determination of the piece part spares required (13). As a consequence of this policy the assessor, who is selected on the basis of experience in the particular field, will use a judgmental determination of the parts required.

An assessed part is one that the assessor considers necessary to be purchased at the same time as the initial system acquisition. The piece part spares assessed as

required should then be compared with the current inventory stocks of parts. The assessed parts can be classified as common or unique. Common parts are those that are the same as ones currently identified in the inventory. Unique parts are thus those parts that are not the same as any parts in the inventory. Once the part has been classified as common or unique then a determination can be made regarding the particular project procurement requirements. As this comparison and determination is very time consuming, the assessor will normally bypass this step, and indicate that all of the assessed components (common and unique) will be purchased (16).

One alternative is simply to procure only those common assessed items whose introduction will cause the stock levels to fall below reorder values or levels. Other common items need only have their assessed usage rate added to the normal annual and ongoing automatic procurement system. Another alternative is that any unique items are not purchased. If these parts should fail then they are lead time away. Lead time, for Australian parts being analyzed in this study, is the time it takes from realization of the need to the time the part is delivered from the U.S. This is the same situation that exists if a replacement unique item is required due to a component failure and the unique part was not assessed, and thus not purchased with the initial project procurement.

Specific Problem

The RAAF assessment and model determination of spare parts required for an avionics acquisition considers whether the system, sub-system components, or sub-components are common to any parts in the current inventory. Normally, no consideration is given to the level of inventory holdings for common individual electronic component parts (piece parts) within the system. This may result in an initial and total acquisition of too many piece part spares. The majority of repairs carried out on electronic systems are replacement of failed individual electronic components. This, combined with high Mean Time Between Failure (MTBF) rates for electronic components and low RAAF Rate of Effort (ROE), may result in an over acquisition of spares.

Research Objectives

The objective of this research is to determine if an over-procurement of assessed piece part spares has resulted because commonality of piece part components has not been considered. This will be completed in two different ways.

The study will ascertain if there is commonality of piece parts between those in an avionics system and the RAAF's currently held inventory stock of avionics piece parts. If commonality is shown to exist, then this study will determine if making an allowance for this commonality

would result in the acquisition of less spares than would otherwise be required.

This study compares the cost benefits gained from the first analysis with the benefits gained by not procuring any of the unique items. The alternative is to only procure those common components whose introduction would otherwise deplete stock holdings below the minimum acceptable levels because of the introduction of the new system.

Scope and Limitations

This research involves the data analysis for a single item of avionics equipment and the commonality determination is then hypothesized to other avionics systems. The system that has been studied is the VHF AM Transceiver Type 618M-3A, manufactured by Rockwell Collins. This item is one of the RAAF's latest avionics acquisitions, and was spares assessed, to the first three parts levels, using the Poisson Availability Target Technique for Recoverable Item Control (PATTRIC) model and many manual computations. The avionics system was procured as a part of the ongoing P3C Orion aircraft avionics update, and although many of the avionics in the new P3C are common to the RAAF inventory, the 618M-3A is a unique item.

The study only involves the current RAAF avionics piece part inventory, and does not involve a commonality comparison between any number of separate avionics systems.

This research does not attempt to discuss the methods of data comparison necessary for commonality determination for future avionics acquisition, but makes recommendations for the requirements for such comparisons.

Although the PATTRIC model will be discussed, this study will not attempt to present the model changes required to incorporate the commonality of piece parts in a spare parts acquisition determination.

Assumptions

It is assumed that the avionics system studied is representative of future avionics systems likely to be introduced into the RAAF inventory.

Summary

This chapter has provided a brief background to the nature of this study, a statement of the specific problem being analyzed, the research objectives resulting from the problem, and the scope limitations and assumptions of the research. The following chapter will discuss the literature that is relevant to this thesis.

II. Literature Review

Introduction

Much literature is available that analyzes the effects of commonality on inventory levels and procurement models, but little has been written that relates to the piece part analysis undertaken in this thesis. This chapter details writings that relate to piece part analysis, the RAAF procurement procedures and associated documentation, and an outline of the mathematical method of analysis used in this study.

The Study of Commonality

Commonality of components has been given considerable priority within the USAF, mainly because of the high degree of commonality that exists, and the subsequent savings that can be realized (8:4-1). However, this consideration of commonality of components exists only at the major component or system level. No research appears to have been done on the commonality of components at the piece part level.

One study that was done by Baker, Magazine, and Nuttle in 1986 was not as specific as this study, but has some important findings. The authors stated that all previous studies related to commonality have dealt with extreme cases which compare systems with no parts commonality at all with those having full commonality (3:982).

The Baker et al study "examines the effect of component commonality on optimum safety stock levels in a two-product, two-level inventory model" (3:982). In the study it is stated that "For more than two-end items or more than two components per end-item or more than two levels, the possibilities for commonality are more numerous and much more complicated to analyze" (3:987).

The research did produce an insight: "Commonality induces a change in the optimal stock of unique components as well as common components" (3:983), that is, "safety stock of unique parts increases when commonality is introduced" (3:983). Despite this apparent rise, the research concluded that they could "maintain the service level by reducing the common stock by more than we increase the total unique stock" (2:986). The model analysis "shows that commonality does permit a given service level to be attained with a smaller safety stock than would be attainable without commonality. This result reinforces the desirability of increased component commonality" (3:982).

Although the above study highlights an important theoretical aspect regarding common and unique items, it does not apply to the RAAF system. The level of stock required for unique parts does not increase when common items are introduced. The parts assessed as unique are procured at a determined level regardless of whether or not there are common parts in the avionics system being assessed.

RAAF Procurement Procedures

The RAAF Directorate of Maintenance Policy, Air Force Office (DMP) has empowered project teams to use an initial provisioning mathematical model, Poisson Availability Target Technique for Recoverable Item Control (PATTRIC) for any capital project spares acquisition determination (12). This model is similar to the family of Multi-Echelon Technique for Recoverable Item Control (METRIC) (14) models used in the United States Air Force (USAF).

The PATTRIC model has been refined to provide the necessary weighting to the two acquisition considerations mentioned. The model was also developed separately from the METRIC models to allow for the relatively small aircraft fleet size (13).

Like the METRIC models, PATTRIC includes a hierarchical or indentured parts structure (14). The model permits two levels of parts to be considered (down to the third level in the system hierarchy), an assembly and its components. It is possible to extend the analysis to additional levels of indenture or to two or more echelons of supply using a straightforward extension of the normal model methods (7:475).

To be able to extend the models to the lower levels of indenture it is necessary to explicitly describe the systems relationships between the upper and lower hierarchical elements. It is then necessary to partition the overall

problem to the sub-component level and perform a model analysis on each of the piece part groups (7:476).

Studies have shown that when lower level indenture analysis has been done on historical data, the actual maintenance has not agreed with the model predictions (1:2-12). The maintenance has involved removal of the sub-system or sub-component, repair by replacement of the necessary piece parts, and then reinstallation of the sub-component or sub-system. The result is a considerable overstatement of the spare parts required (1:2-12).

Although the PATTRIC model is authorized for use as stated above, the final determinant of the models usage for a particular project is the Logistic Management Directive (LMD) issued (11). For the avionics system being analyzed, LMD number 1-82/83 for project AIR 72 provides that authority (11:38). Project AIR 72 is the project name and number used for the procurement of "10 P3C Orion aircraft, the disposal of 10 P3B Orion aircraft, the acquisition of aircraft spares and support equipment, and the acquisition of the AQS-901 Sonics Processor Systems with associated spares and support equipment, plus the integration of the AQS-901 Systems into the new P3C Orion aircraft" (11:2) by the Royal Australian Air Force.

The LMD also stipulates that "Project Air 72 seeks to acquire additional aircraft and systems of a type already in RAAF service and as such some reductions can be expected in

the initial level of supply support required. As a high degree of commonality will exist between the new aircraft and systems being acquired and those currently in service, cognizance is to be taken of existing asset levels in an effort to rationalize support costs. Procurement requirements in respect to this project will therefore be limited to those items which are unique to the new P3C aircraft and Sonic Processor Systems and those common items for which support cannot be provided from existing assets" (11:14). The LMD further states that "Procurement requirements in respect to this project are to be offset against surplus existing RAAF assets, ie those physical assets in excess of mutually agreed inventory holding levels. As Project Air 72 relates to the acquisition of aircraft and systems currently in service a high degree of commonality with existing assets is anticipated, and hence, the potential to offset a larger number of requirements than could be expected in other projects" (11:62). Notwithstanding the LMD objectives of commonality and offset, the 618M-3A is a unique avionics system although many piece parts may be common to the existing RAAF inventory.

Data from the Project Air 72 is used in this study, and for the determination of aircraft availability associated with not acquiring or stocking unique parts. This data will be manipulated using a mathematical model.

Mathematical Model

The Logistics Management Institute's (LMI) availability model was used as a starting point for the analysis contained in the article by Dr. Demmy et al (5:23). The model was developed by LMI as a means of relating the expected number of operational aircraft to alternate Air Force stocking policies. Proofs and other mathematical details for this model are presented in Appendix 3 of the LMI report (LMI).

The LMI availability model includes the following variables:

N = the quantity of aircraft in the system.

j = the index of a particular component, or item, of the aircraft, $j = 1,2,\ldots,K$, where K is the total number of items.

c_j = the unit cost of component j.

QPA_j = the quantity of component j on one aircraft.

s_j = the quantity of spares for component j stocked at a particular location.

$BO_j(s_j)$ = the expected quantity of back orders on component j when the stock level for this component is s_j.

In this model it is assumed that demands obey a stationary Poisson process, that repair and resupply times are independently random variables, and that an $(s-1,s)$ inventory policy is used. Expected back orders at a random point in time are given by

$$BO_j(s_j) = \Sigma_{x=s_j+1}(x-s_j)p(x|\mu_j) \quad s_j = 0,1,2,... \qquad (1)$$

where $p(x|\mu_j)$ denotes the probability that there are x assets in the repair/resupply pipeline and μ_j denotes the expected number of assets of item j in repair or resupply. In the special case where $s_j = 0$, $BO_j(s_j) = \mu_j$. That is, if there are no spares, the expected number of back orders equals the expected number of assets in the repair/resupply pipeline.

Now let q_j denote the probability that a randomly selected aircraft at a randomly determined point in time does not have any components of type j missing. Mathematically,

$$q_j = \left(1 - \frac{BO_j(s_j)}{N \cdot QPA_j}\right)^{QPA_j} \qquad (2)$$

This expression results from the following arguments: If all N aircraft are to be operational, and QPA_j is the number of component j on one aircraft, then the total number of units of component j needed is $N \cdot QPA_j$. Remember that $BO_j(s_j)$ denotes the expected number of "holes" in the aircraft due to the back orders of component j when s_j is the base stock level. Hence, $BO_j(s_j)/(N \cdot QPA_j)$ is the probability that a requirement exists for item j due to the back order on that item. Hence, one minus this value is the probability that a given unit of component j is not causing the aircraft to be inoperable. Finally, since each aircraft

contains QPA_j units of component j, the probability that each component j unit is operational must be raised to the QPA_j power to determine the probability that all QPA_j units are operational simultaneously. This then gives the above expression for q_j.

Once the component availabilities q_j are known, Q, the probability that a randomly selected aircraft is operational, can be determined. This is given by

$$Q = \prod_{j=1}^{K} q_j \tag{3}$$

That is, the probability that a randomly selected aircraft is operational equals the probability that none of its components is in a back order status. Finally, the expected number of operational aircraft in a fleet of N aircraft is Q·N. Hence, the expected number of operational aircraft, ENOA, is given by

$$ENOA = Q \cdot N = \left(\prod_{j=1}^{K} q_j \right) \cdot N \tag{4}$$

Without loss of generality, it is assumed that each item j is numbered in order of increasing demand rates. Hence, ENOA may be written as

$$ENOA = Q \cdot N = \left(\prod_{j=1}^{J} q_j \right) \left(\prod_{j=J+1}^{K} q_j \right) \cdot N \tag{5}$$

where J denotes the number of items with very low demand rates. This expression may be further simplified to $ENOA = Q^L \cdot Q^H \cdot N$, where Q^L and Q^H denote the first and second product terms respectively on the right hand side of the above expression. The term Q^L denotes the probability that a low demand item is not causing a "hole" in a randomly selected aircraft, while Q^H similarly denotes the probability that a high demand rate item is not causing an aircraft to be inoperable.

If no back orders ever occurred for low demand items, the expected number of operational aircraft would be $N_0 = Q^H \cdot N$. Hence, Q^L measures the impact upon aircraft availability after accounting for supply problems for the high demand rate items. Combining the above relations gives

$$ENOA = N_0 \cdot Q^L = N_0 \cdot \prod_{j=1}^{J} \left(1 - \frac{BO(s_j)}{N \cdot QPA_j}\right)^{QPA_j} \tag{6}$$

In the following analysis, the focus is on stocking policies for low demand rate items represented in the product term on the right hand side of (6). Since each of these items has a low demand rate, (6) may be greatly simplified. The equation may be written in expanded form using the binomial expansion as:

$$ENOA = N_0 \cdot \prod_{j=1}^{J} \left(1 - \frac{BO(s_j)}{N \cdot QPA_j} + \frac{QPA_j(QPA_j-1)}{1 \cdot 2} \left(\frac{BO_j(s_j)}{N \cdot QPA_j}\right)^2 - \ldots\right) \tag{7}$$

For low demand items, $BO_j(s_j)$ will be very small, even when $s_j = 0$. Hence, in this case, all terms involving quadratic or higher powers of BO_j will be negligible. Thus, a good estimate of ENOA is given by

$$ENOA = N_0 \cdot \prod_{j=1}^{J} \left(1 - \frac{BO(s_j)}{N \cdot QPA_j}\right) \tag{8}$$

If equation (8) is then expanded the following is obtained:

$$ENOA = N_0 \cdot \left(1 - \frac{\Sigma_j BO_j(s_j)}{N} + \Sigma_{ij} \frac{BO_i(s_i)\,BO_j(s_j)}{N^2} - \ldots\right) \tag{9}$$

Again, if $BO_j(s_j)$ is small, the third and higher order terms inside the brackets will be negligible. Hence, if only low demand items are considered, a good estimate of the expected number of operational aircraft is

$$ENOA = N_0 \cdot \left(1 - \Sigma_j \frac{BO_j(s_j)}{N}\right) \tag{10}$$

which may be written as

$$ENOA = Q^H \cdot \left(N - \Sigma_j BO_j(s_j)\right) \tag{11}$$

From this, the expected number of operational aircraft equals Q^H times the number of assigned aircraft, N, less the expected number of aircraft that are inoperable due to the lack of serviceable spares for each low demand item j.

If an item j is not currently stocked at a given base, then $s_j = 0$. Hence, from the above, the expected number of operational aircraft at this base is reduced by $BO_j(0)$ due to the back orders on item j. From Sherbrooke (1966) this term is

$$BO_j(0) = \mu_j = \lambda_j T_j \qquad (12)$$

where

μ_j = the expected number of back orders of item j

λ_j = the demand rate for item j

T_j = average repair/resupply time for item j

In general, if the stock level for item j is increased by one unit (to $s_j + 1$), the increase in expected operational aircraft is, from (6),

$$\Delta ENOA_j = Q^H \cdot \Big(BO(s_j) - BO(s_j + 1) \Big) \qquad (13)$$

For low demand rates, the expected number of assets μ_j in the repair/resupply system for a specific item j is often approximately Poisson distributed. By expanding equation (13) and substituting the Poisson probability formula the resultant derivation is

$$\Delta ENOA_j = Q^H \cdot \left(\mu_j - \frac{\mu_j^2}{2!} + \frac{\mu_j^3}{3!} - \frac{\mu_j^4}{4!} + \ldots \right) \qquad (14)$$

As this study is restricted to unique and common parts of low demand rates, the values of μ_i will be small. Typically for an item with two demands per year and a repair/resupply time of 10 days, then $\mu = \lambda T < 0.055$. Thus, if λ is small, the quadratic and higher terms of (14) are negligible. In this case, equation (14) can be approximated by

$$\Delta ENOA_i = Q^H \cdot \mu_i = Q^H \cdot \lambda_i T_i \tag{15}$$

This simple result states that the expected change in the number of operational aircraft at a given base due to having or not having one spare of a low demand item at that base approximately equals the product of Q^H, the probability that no higher activity item is causing an aircraft to be unavailable, and of μ_i, the expected number of backorders associated with holding no spares.

Equation (15) will be used in the following chapter to determine the change in the expected number of operation aircraft that results from not purchasing any of the unique spares assessed.

Summary

This chapter contains an outline of literature related to this thesis, including piece part analysis, RAAF procurement procedures, and a mathematical model. The following chapter will detail the methodology to be used for the necessary data analysis.

III. Methodology

Overview

The overall objectives of this research is to determine if an over-procurement of assessed spares has resulted because commonality of piece parts has not been considered. This chapter describes the specific methodology employed to accomplish the research objectives.

The acquisition of the VHF AM Transceiver Type 618M-3A system provided the unclassified data for this research. This data, in two separate forms, was collected and analyzed, the common components were grouped, and then the components were compared with the RAAF inventory. The comparison included a determination of the levels of stocks required before and after introduction of the 618M avionics system. An analysis was then done on the effects of a procurement which would only involve the purchase of those items that are common and whose expected usage rate would lower their associated spares stock level below the minimum reorder quantity.

Data Collection

The Illustrated Parts Breakdown book (IPB) for the recently acquired 618M-3A provides a progressive system breakdown of the system components. The system is displayed as a number of sub-systems. The sub-systems are then

displayed as a series or number of sub-components. The final breakdown involves a pictorial representation and tabulated description of the piece parts in each sub-component (15),(9). Included as a part of the tabulation is a description of each component, the manufacturer's part number, and national manufacturing code. These can be cross referenced with another tabulation to determine the corresponding Military Specification (MIL SPEC) reference code and MIL SPEC manufacturing code.

Having done the sequential breakdown of components to their smallest part, and excluding commonality, the IPB for the 618M-3A system indicates that there are a total of 4876 individual piece parts within the transceiver unit (15),(9). Each of these piece parts is then analyzed by the project assessor and he makes a determination as to which parts he considers are either essential or likely to fail. This determination is then cross-referenced with the IPB data to produce the List of Assessed Spares (LOAS). This list contains those components considered essential to be procured, and the number of units of each item required in the system. For the 618M-3A, the LOAS contains 410 line items, totalling 1917 piece part components.

The other data required was obtained through the RAAF Headquarters Support Command Logistic Support Office. Utilizing access to the on-line computer, RAAFSUP UNIVAC, and requesting a General Adhoc Review Selection Process (GARSP)

report, gives access to a variety of acquisition and status reports. Of these reports, Paramatised Analysis of Stock Numbers (PASTNO) for LOAS entry number 20862, furnished the required data for final analysis of the research problem.

Data Input and Validation

Data obtained from the IPB was fully cross checked against the listings of the LOAS for the 618M-3A system. All items highlighted in the IPB as necessary procurements were compared with the line items in the LOAS to ensure validity of the entry, including NATO Stock Number (NSN), item name, and quantity required. This validated data was then entered into the commercial relational database dBASE III Plus.

The GARSP output contains up to 32 sections of information on each of the 633 components specified, and of the 32, only seven were required for this analysis:

1. NSN (NATO Stock Number);
2. COST (the cost of purchase of a single item);
3. ITEM TOTAL (the quantity of that item in stock);
4. USAGE FORECAST (average predicted annual usage for the next three years);
5. USAGE PAST-ACTUAL (average actual annual usage rate for the past three years);
6. PAQ (Provisioning Action Quantity - the number of items below which, procurement action is taken to replenish stocks); and
7. COMMONALITY (whether or not the item is unique to the 618M-3A system).

Because the GARSP database has the relevant data input directly to it, and is thus the authoritative database, the GARSP output could not be validated against any other reference, and was simply input into the same database package. Both of the databases were then checked against the LOAS and GARSP outputs to ensure validity, and to confirm that only piece part components were included.

Data Manipulation

Using dBASE III's relational capabilities, both databases were then indexed on their common field of NSN. These common indexed fields were then used to provide a consolidated database that had all of the information necessary from both of the databases. The method used for this was the dBASE III "View" capability. Although this procedure does not create a physical database or database file, it does allow access to the information in either or both of the databases used.

To be able to use the information available from the "View", two further steps were necessary. A small command program was written using the dBASE programming language, and a dBASE report format was created.

The dBASE Program. The program enabled the selection and printing of either the common or unique components without having to filter either out using the dBASE report capability. The program also allowed the analysis of only

those unique components having low failure/demand rates, as stipulated in the mathematical model. Finally, the program permitted the analysis of only those common components whose purchase was not necessary because of adequate stocks.

The program, shown in Appendix A, initially confirms whether to analyze the common or unique components in the databases. If the reports are to be printed, then the next query enables that selection. The relevant "View" is then called, the program starts at the top of the records the "View" contains, and then iteratively selects the desired or suitable records from those available.

This selection is done for two reasons. First, for unique components, the parts analyzed and used in the mathematical model must have a low failure/demand rate. The demand rate used in this study was for actual and forecast rates less than three per year. This figure was chosen because of the recommendations in the Demmy et. al. study (5:27), and because it was an obvious cut off point in the data values. Secondly, the final part of the program selects for analysis, those common components whose introduction would not probably lower stocks, at some time during the reorder period, below the PAQ for the item. This was achieved by selecting only those components for which:

STOCK - (PAQ + FORECAST USAGE) or

STOCK - (PAQ +ACTUAL USAGE) > 0.

Thus, only values greater than zero would be included. These are the items that are held in stock in quantities greater than is needed, even accounting for the introduction of the new avionics system, and the subsequent higher parts demand rate.

The dBASE Reports. Mathematical manipulations involving quantities and cost, for both common and unique components, were effected through the use of specific report formats. The reports were also used to print all of the data information required for the remainder of the analysis.

The first seven columns of the two reports contain information retrieved from the two databases, LOAS and GARSP, without any mathematical computations. The column headings and contents are as follows:

1. NSN (NATO Stock Number - used as the index for both databases);
2. COST (Cost per item - from the GARSP report);
3. STOCK (Number of items currently held in inventory - from the GARSP report);
4. PAQ (Provisioning Action Quantity - from GARSP the report);
5. FCAST (Forecast usage rate - from the GARSP report);
6. ACT'L (Actual usage rate - from the GARSP report); and
7. ORD (Number of parts needed/ordered for the newly introduced system - from the LOAS report).

The final two columns were different for the common and unique reports, and are as follows:

Common Items

1. TOTAL COST OF STOCK = COST x STOCK (This is the total cost of all current stocks of that individual item)

2. TOTAL COST OF ORDER = COST x ORDER (An optimistic cost figure that does not take into account the most cost effective number of items to purchase, but is the cost of the minimum number of parts assessed as required for the new system)

Unique Items

1. COST OF SURPLUS STOCK = COST (STOCK - PAQ - FORECAST) (This figure equates to the cost of stock that is held in inventory above the minimum required)

2. COST OF STOCK ORDERED = COST x ORDER (Again this is an optimistic cost figure that only represents the cost of the parts that were ordered for this new system)

The two report formats also provide totals, by summing each of the numerical columns, and arrange the data into the required page layout.

Final Computations

Determining the effect of not procuring the unique components for the new system is the final element in the mathematical computations for this study. From equation (15) we have the change in expected number of operational aircraft, $\Delta ENOA_i$ is given by

$$\Delta ENOA_i = Q'' \cdot u_i = Q'' \cdot \lambda_i T_i \qquad (15)$$

where Q'' is the probability that no higher activity item is causing an aircraft to be unavailable, λ_i is the demand rate

for item j, and T_j is the average repair/resupply time for item j.

From the Logistic Management Directive (LMD) for the P3C Orions, the expected aircraft availability, assuming that all components are procured, is 99%, and this can be assumed to be a suitable value of Q^R.

From the notes received from Headquarters Support Command (HQSC)(6), there are two extremes of values available for T_j. The high value is 83 days per item. This value obtained is the total average of all action times, where action time is the total time from removal/requisition to repair/resupply. These action times include those components deemed to be of high and/or low priority. The assumption made throughout this analysis is that the lack of any piece part component will cause an aircraft to be unavailable, and thus this large value is not totally relevant, but will be used as an authoritative example of the effect of parts availability on aircraft availability.

The low value is 23.07 days per item. This value is also the total average of all action times but these actions are all high priority. The value is obtained by assuming that when a piece part fails, there is no replacement, and consequently, the aircraft will be unavailable until the part is replaced. From the mathematical model requirements, this is the figure that is required for the computations.

Since equation (15) is for item j, and the unique components being analyzed are j = 1, 2, 3, ... J, where J denotes the number of items with low demand rates, then the total number of demands per year is the sum of either the forecast or actual demands per year, and this is the figure that is stated in the report output totals. This figure, when multiplied by $Q^{\#}$ and T_j will give the total expected change in the number of operational aircraft considering all low demand rate parts.

Meeting the Objectives

The objectives of this research were to determine if allowing for commonality of piece parts would reduce the required inventory holdings of same, and to ascertain if there was any benefit gained by not acquiring those unique parts that were assessed as required.

By appraising the two cost figures from the analysis of common components, the benefits gained from not acquiring too many piece parts can be determined.

Although not as simple as for common components, the benefits gained from not acquiring unique components may be determined from the data and figures presented so far. Thus, both of the research objectives should now be able to be met.

Summary

This chapter has outlined in detail the methodology used for acquiring, in-putting, validating, manipulating, using, and presenting the data required to meet the research objectives. The following chapter will discuss and analyze the results obtained.

IV. Findings and Analysis

Overview

This chapter uses the information obtained from the previous chapter to determine the costs and benefits to be gained or lost by considering commonality during the piece parts procurement phase.

Results

The results of the two analyses, one for common components and one for unique components, are presented separately.

Common Components. The data presented in Appendix B reveals that there are 373 different components, in the 618M-3A system, that are common to the RAAF inventory, and for which there were sufficient numbers of these components in stock to adequately cover the increased spares requirement resulting from the introduction of the new system. The data also indicates that there were a total of 883 of these common components deemed as required for the 618M-3A system, and that these components would cost a total of $1736.31.

Economic Order Quantity (EOQ) is the most economical purchase quantity of a particular item, and is normally the aggregate number of components purchased in a consolidated order. Because EOQ figures for all of the components in the 618M-3A were not available, the number of components

actually purchased for the newly introduced system is not available. Because the LOAS values are the minimum order required, the equivalent component EOQ figure must be at least as large, if not greater than the 883 shown in the LOAS as being required. Thus, the savings to be gained by not purchasing these common components would also be greater than the figure calculated above.

The data also shows that there are a total of 9039 of these common components, costing $63,079.63, that are actually surplus to the most pessimistic of projected requirements. If the procurement policy was altered, such that only those components that are required to be purchased to maintain adequate stock levels are purchased, then this dollar amount is the overall, or long term savings that could be gained.

All of these figures are determined solely from the basic cost of the components, and do not take into account the order processing, purchasing, transportation, handling, warehousing, and inventory carrying costs associated with these surplus items.

Unique Components. The total cost of the 368 unique components associated with the new avionics system, and held in stock, is $1229.80, and is the amount that could be saved by not procuring the components.

Each of these components is a low demand item. The average change or decrease in ENOA associated with not

purchasing any of these components will fall within a certain range depending upon whether any or all of the components are treated as high or low priority. If all of the failed unique components cause an aircraft to be unavailable, the acquisition will be given high priority, and the resultant value of the decrease in ENOA is 0.063 per component. If none of the parts cause an immediate aircraft unavailability, then these low priority components will cause an associated reduction in ENOA of 0.225 per component. Obviously, because not all components will be either high or low priority, rather, there will be a mixture of high and low priority components, the actual figure will be somewhere between these two figures.

Using the total forecast number of spares required, 11, and assuming that any component that is essential will be treated as high priority, gives a total decrease in ENOA of 0.688. This represents a pre-procurement planning figure that may be used to determine whether or not it is cost effective to purchase any or all of the unique components. The total fleet of P3C Orions is 10. The projected decrease in ENOA means that 9.312 aircraft are now available, and this represents a 93.12% aircraft availability.

By using the actual number of components required, 5, the total reduction in number of aircraft operationally available is 0.313. This is the actual reduction in aircraft availability for the year that would have literally

resulted if the all of the unique components had not been purchased. When compared to the total of ten aircraft in the fleet, this reduction can be represented as a 96.87% aircraft availability.

Analysis of Results

The previous section of this study completed the final calculations that are relevant to the analysis, and presents the mathematical results. This section discusses the significance of these results, and will also consider the relevance of these same results when consideration is given to some practical aspects of avionic components and their procurement.

Common Components. Although the final figure of $1736.31 is not a very large amount, the value of $63,079.63 is. The actual savings that could have been realized during the procurement of the 618M-3A avionics system is probably larger than the first figure quoted, but could not be determined in this study because the relevant EOQ figures were not available.

As stated, the second figure represents the amount that could be saved if all of the unnecessary or surplus components were not purchased. Obviously this figure could not be realized immediately, but would take time between the implementation of a changed policy and the utilization of all of the surplus components.

The final point to realize from the common component analysis is that the above figures would be an underestimation if the unique component aspect of this study was also considered. While entering the data for both aspects of this study, it was obvious that many of those components that are common to the inventory are only common with one or two other systems. Each of these components had a low predicted or actual usage rate, if any. If these components had not been purchased in the first place, there may have also been no need to procure another quantity for the new system. The argument is circular, in that the less components purchased for a system, the less components there are to be common to the next system, and the less that need to be purchased.

The main detractor from the argument above is that the less components that are available in the inventory, the lower the likely aircraft availability. Obviously there are cost savings to be gained by considering commonality of components, but each analysis of unique components must be undertaken separately.

Although this analysis considers what components are currently available, the possible or likely loss of inventory due to time of life expiration is not. Any items that are purchased in excess of the projected or actual demand will thus not be required for an unknown, unspecified, but definite period of time. This period of time may exceed the

components allowable shelf-life time, thus wasting further resources.

The other factor to consider is that the 618M-3A is only one of a number of new avionic systems introduced with this latest new aircraft addition to the RAAF inventory. The minimum cost savings, for each of these avionics systems, when applied across the entire range of new systems introduced in a single year, can mean substantial savings during the procurement and support stages of an acquisition.

Unique Components. Once again, the costs associated with the procurement of unique components is understated. Because the actual total, or EOQs of the components purchased for the 618M-3A system are unavailable, the only totals used were those available for the items remaining in stock. Although the difference is only minor, the actual number of parts procured for the introduction of the new system is however, slightly larger than the number of components currently in stock. Consequently, the amount of $1229.80 is somewhat understating the cost of the spares for the introduction of the new avionics system.

Being realistic, the calculated reduction in effective number of operational aircraft is overstated. The calculations of reduction in ENOA were made assuming that every single component failure will cause an aircraft to be unavailable until the required item is provided by the retailer or supplier. Among the things that ensure that this does

not happen are the holding of sufficient spares of level 3, 2, and 1 components. These components are held in sufficient supply, such that there can be a number of them being repaired without affecting the serviceability or availability of the fleet of aircraft. This quantity of higher level components is determined using the PATTRIC model. Another option available is to use the money saved by not procuring the unique components to acquire more of these level 3, 2, and 1 items, and therefore increasing the expected aircraft availability.

There is also fact that all three of those levels of components can have their available and serviceable parts used as spares for the unserviceable items. Although discouraged, this last resort, called cannibalism, does occur, and can increase, or at least maintain an aircraft availability/serviceability level until the required spares become available. This last resort will probably maintain the availability above the calculated/predicted 93.12%.

For the analysis completed in this study, it has been assumed that Q^H, the probability that a high demand item is not causing an aircraft to be inoperable, is 99%. If this figure is actually smaller, then the decrease in effective number of operational aircraft is reduced also. This may be determined either mathematically, or intuitively by realizing that if an aircraft is unavailable due to a high demand part not being available, then while waiting for that part,

there is the possibility of resupply of the required low demand item also. Each procurement, not only at the system or level 1 tier, but also at the weapons system or major weapons system component level, must therefore be analyzed to determine the benefits versus deficits of not procuring certain spare unique components.

Summary

This chapter has presented the final results of this study of component commonality, and a subsequent analysis of these results, including some realistic perspectives. The following chapter is the concluding chapter, and details the final conclusions and recommendations of this study.

V. Conclusions and Recommendations

Conclusions

There are significant savings to be realized by considering commonality during the procurement phase for a new avionics system. These savings can be effected by reappraising the procurement policies for common, unique, and a combination of both types of piece part components.

Common components need not be held in quantities surplus to the projected parts requirements, consistent with the scheduled procurement cycle. Nor is there any requirement to purchase additional common components associated with the introduction of a new system. This study has found no detrimental effects that can be identified with this type of policy. Any savings that can be gained by analyzing common components in a new system does not need to be subject to a cost-benefit analysis. There are no detractors against which to compare the savings.

Compared to the cost of an aircraft, or even a small percentage of one, the cost savings associated with not purchasing the assessed unique components are small. Demmy et. al. came to these conclusions, and recommended that adequate spares be available to maintain the desired operational level or flying rate (5:27). For the Royal Australian Air Force, where funds are limited, that solution may not be optimal. The reduction in aircraft availability may

be worthwhile or acceptable if substantial savings can be effected. Each projected procurement must be analyzed and a cost-benefit determination made for each new system.

Any reduction in either the inventory levels or components procured also has a number of tangible benefits that cannot be as readily calculated. These benefits include reduced wastage, lower order processing, purchasing, transportation, handling, warehousing, and inventory carrying costs. These costs should not be ignored in any of the determinations, especially if the decision to acquire is contentious.

Recommendations

All new avionics systems should be analyzed to determine the level of commonality of piece parts with those currently in the RAAF inventory. Those parts that are common to the inventory should not be purchased unless the new systems introduction would possibly reduce the stock levels, during the procurement cycle, below the Provisioning Action Quantity for that item.

One of the main restrictions with the implementation of the above recommendation is that the present RAAF assessment method is manual, and too time consuming. As this form of analysis can provide considerable manpower and monetary savings, it is recommended that programs be developed to utilize current capabilities and allow a computerized

determination of common component acquisition requirements. Once computerized, the determinations could be expanded beyond just the RAAF inventory and systems to include the Army and Navy as well.

Because the above process can produce considerable savings, it is also recommended that this commonality comparison be carried out for other component and system types other than avionics. Another possible consideration is using the same methods to assess any benefits of acquiring one type/brand of system over its contenders.

Unique piece part procurement should be analyzed for each system proposed. There are savings to be made by not procuring these quantities of unique components, but to the detriment of aircraft availability. Unique piece part components should not be purchased for those proposed systems that demonstrate a potential cost saving, for a small reduction in aircraft availability.

Because actual trial studies, in which unique parts are not purchased, would mean an unwanted reduction in aircraft availability, it is recommended that a simulation program be developed to emulate the likely results, and that those results then be used to establish a unique piece part procurement policy for the RAAF.

Economic Order Quantity values, for components comprising the system analyzed in this study, were not available. As a consequence of this, firm savings figures for the

common component analysis were not able to be determined. A follow on study is recommended using EOQ's and possibly analyzing systems from either another field, such as engines or ground support equipment, or even for multiple or large systems.

Appendix A: dBase Program

```
SET TALK OFF
CLEAR
ACCEPT 'Analyze Common or Unique Components ? (U/C) ' TO UC
CLEAR
ACCEPT 'Do you want this report printed ? (Y/N) ' TO YN
  IF UPPER (YN)="Y"
    SET PRINT ON
  ENDIF
CLEAR
SET VIEW TO ALL1
GO TOP
DO WHILE .NOT.EOF()
  IF UPPER(UC)="U"
     REPORT FORM UNCOMM FOR COMM_UNIQU ='U'.AND. ACTUAL < 3
.AND.
     FORECAST < 3
  ENDIF
  IF UPPER(UC)="C"
    REPORT FORM COMM FOR ITEMS_TOTA - (PAQ + ACTUAL) > 0
.AND.
    ITEMS_TOTA - (PAQ + FORECAST) > 0 .AND. COMM_UNIQU = 'C'

  ENDIF
ENDDO
SET PRINT OFF
RETURN
```

Appendix F Common Spare Parts

NSN	COST	STOCK	PAQ	FCAST	ACT'L	ORD	COST OF SURPLUS STOCK	COST OF STOCK ORDERED
5305-00-045-1628	0.01	84	0	0	0	0	0.84	0.00
5305-00-054-5637	7.55	82	41	27	12	2	105.70	15.10
5305-00-054-5638	0.97	38	15	10	7	2	12.61	1.94
5305-00-054-5640	25.51	16	7	5	2	2	102.04	51.02
5305-00-054-5642	0.79	103	10	7	2	5	71.89	3.95
5305-00-054-5643	0.04	364	232	155	157	0	19.08	0.00
5305-00-054-5647	1.43	1456	58	39	17	5	[illegible]	7.15
5305-00-054-5648	0.94	96	53	34	35	6	8.46	5.64
5305-00-054-5650	0.63	33	16	11	12	3	3.78	1.89
5305-00-054-5654	6.84	34	12	8	1	16	95.76	109.44
5305-00-054-6652	0.21	4726	1079	694	757	13	820.13	2.73
5305-00-054-6653	0.90	81	37	24	22	11	18.00	9.90
5305-00-054-6654	1.27	80	33	22	14	5	31.75	6.35
5305-00-059-8447	0.01	1774	483	200	0	0	10.91	0.00
5305-00-059-8448	0.25	6	0	0	0	0	1.50	0.00
5305-00-059-8450	1164.96	3	0	0	0	0	3494.88	0.00
5305-00-114-0087	0.30	41	21	14	0	2	1.80	0.60
5305-00-402-4558	0.02	377	144	96	9	4	2.74	0.08
5305-00-425-3817	0.14	5	0	0	0	9	0.70	1.26
5305-00-490-4581	0.27	210	66	44	0	2	27.00	0.54
5305-00-494-7333	0.29	1000	63	42	116	8	259.55	2.32
5305-00-531-9521	1.76	24	0	0	0	0	42.24	0.00
5305-00-579-3021	10.10	3	0	0	0	0	30.30	0.00
5305-00-619-5560	2.27	604	0	0	0	0	1371.08	0.00
5305-00-638-0653	0.01	33	0	0	0	0	0.33	0.00
5305-00-638-8030	9.06	4	0	0	0	0	36.24	0.00
5305-00-685-4309	0.05	101	1	1	35	1	4.75	[illegible]
5305-00-763-3356	1.11	50	17	11	3	2	14.43	2.22
5305-00-763-3965	1.47	16	7	5	1	1	5.88	[illegible]
5305-01-057-6672	0.07	200	2	2	2	1	[illegible]	[illegible]
5310-00-043-1754	1.00	4	0	0	1	[illegible]	4.00	[illegible]
5310-00-136-6133	0.01	566	389	161	17	1	0.16	0.01
5310-00-141-1816	0.04	105	31	21	3	0	2.12	0.00
5310-00-167-0660	0.10	67	0	0	0	2	6.70	0.20
5310-00-216-3522	0.02	2630	1317	878	0	0	8.70	0.00
5310-00-261-7717	0.05	29	0	0	0	1	1.45	0.05
5310-00-271-4640	0.01	4270	0	0	0	[illegible]	42.70	[illegible]
5310-00-515-8243	1.00	148	6	4	1	9	138.00	9.00
5310-00-567-4848	0.19	10	6	3	2	10	0.19	1.90
5310-00-576-7777	0.01	3043	72	30	0	0	29.41	0.00
5310-00-595-7154	0.02	652	60	25	0	0	11.34	0.00
5310-00-614-3500	0.06	3053	1169	495	175	2	33.34	0.12
5310-00-616-3600	0.12	1232	355	237	143	[illegible]	[illegible]	2.76

NSN	COST	STOCK	PAQ	FCAST	ACT'L	ORD	COST OF SURPLUS STOCK	COST OF STOCK ORDERED
5310-00-622-1724	0.05	3318	2160	894	410	2	13.20	0.10
5310-00-674-7629	0.18	181	58	39	1	2	15.12	0.36
5310-00-682-5993	0.06	2908	79	53	11	0	166.56	0.00
5310-00-722-5640	1.00	1572	0	0	1	13	1572.00	13.00
5310-00-722-5652	2.00	3	0	0	0	0	6.00	0.00
5310-00-782-1349	0.23	646	363	242	99	3	9.43	0.69
5310-00-807-1465	6.43	105	60	40	20	2	32.15	12.86
5310-00-820-7155	0.11	793	18	12	0	4	83.93	0.44
5310-00-839-8767	0.13	201	0	0	0	1	26.13	0.13
5310-00-866-3506	0.28	919	124	83	0	7	199.36	1.96
5310-00-883-5931	0.16	855	303	202	0	0	56.00	0.00
5310-00-883-9385	0.02	28	4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5310-00-907-0959	0.06	1779	268	268	16	1	74.58	0.06
5310-00-928-2690	2.69	782	83	55	45	9	1732.36	24.21
5310-00-929-6395	0.37	1274	300	200	193	27	286.38	9.99
5310-00-933-8118	4.79	736	424	283	47	0	138.91	0.00
5310-00-938-2013	1.91	7397	391	261	138	0	12882.95	0.00
5310-00-952-1423	0.08	195	3	4	17	2	15.04	0.16
5310-00-965-1805	1.33	126	0	0	0	0	167.58	0.00
5325-00-641-3425	0.07	4	1	1	0	1	0.14	0.07
5325-00-731-0316	0.21	450	231	154	0	1	13.65	0.21
5325-00-782-7345	0.94	15	2	1	0	1	11.28	0.94
5325-01-085-1766	0.10	13	6	3	0	12	0.40	1.20
5340-00-120-2035	0.18	30	7	5	0	1	3.24	0.18
5340-00-200-2746	0.29	227	0	0	0	2	65.83	0.58
5340-00-282-7966	0.03	659	0	0	0	2	19.77	0.06
5340-00-944-1478	1.74	3	0	0	0	1	5.22	1.74
5340-00-989-9224	0.20	891	423	282	65	1	37.20	0.20
5340-01-031-0350	2.51	25	0	0	0	12	62.75	30.12
5340-01-114-9119	5.00	4	1	0	0	1	15.00	5.00
5365-00-484-6628	0.02	1260	28	28	0	4	24.08	0.08
5365-00-888-9943	0.46	88	34	23	0	4	14.26	1.84
5820-00-857-9438	5.35	69	31	21	2	2	90.95	10.70
5821-00-509-8585	0.54	50	24	16	2	2	5.40	1.08
5821-00-785-6853	1.33	32	12	8	[illegible]	1	[illegible]	[illegible]
5821-00-785-6354	0.37	79	42	28	0	2	[illegible]	[illegible]
5905-00-004-6118	0.27	144	34	23	1	0	23.49	0.00
5905-00-056-9846	0.91	48	21	14	4	1	11.33	0.91
5905-00-060-2467	0.09	60	21	14	4	0	2.25	0.00
5905-00-060-3796	1.85	17	0	0	0	0	31.45	0.00
5905-00-079-3568	0.11	1	0	0	0	0	0.11	0.00
5905-00-088-0635	1.63	325	45	30	25	0	407.50	0.00
5905-00-104-8358	0.08	433	147	98	66	4	15.04	0.32
5905-00-104-8366	0.13	149	26	17	15	1	13.78	0.13
5905-00-104-8368	0.14	601	401	162	173	8	5.32	1.12
5905-00-105-7763	0.04	359	207	138	111	5	0.56	0.20
5905-00-106-1357	0.06	634	337	225	159	1	4.32	0.06
5905-00-106-3667	0.06	343	142	95	82	1	6.36	0.06

NSN	COST	STOCK	PAQ	FCAST	ACT'L	ORD	COST OF SURPLUS STOCK	COST OF STOCK ORDERED
5905-00-107-0656	0.14	2192	1508	624	274	8	8.40	1.12
5905-00-109-9176	2.32	1	0	0	0	0	2.32	0.00
5905-00-111-1684	0.05	282	84	56	12	0	7.10	0.00
5905-00-114-0711	0.07	1385	935	387	175	15	4.41	1.05
5905-00-114-5344	0.09	751	241	99	111	2	36.99	0.18
5905-00-114-5361	0.31	593	325	217	104	1	15.81	0.31
5905-00-114-5407	0.11	521	196	131	108	1	21.34	0.11
5905-00-115-3560	0.05	248	113	74	72	2	3.05	0.10
5905-00-115-7953	0.16	320	186	77	44	1	9.12	0.16
5905-00-116-8555	0.11	347	199	128	132	1	2.20	0.11
5905-00-119-8768	0.18	3343	215	89	31	2	547.02	0.36
5905-00-120-3154	0.08	965	594	246	199	6	10.00	0.48
5905-00-121-9932	0.08	657	292	121	72	1	19.52	0.08
5905-00-135-6046	0.42	382	213	142	112	2	11.34	0.84
5905-00-138-6996	0.13	74	16	11	1	3	6.11	0.39
5905-00-139-1677	0.23	39	21	14	0	3	0.92	0.69
5905-00-141-0742	0.03	252	147	61	58	1	1.32	0.03
5905-00-141-0744	0.17	481	314	130	108	3	6.29	0.51
5905-00-141-1183	0.06	1739	952	394	781	6	23.58	0.36
5905-00-171-2006	0.02	3	0	0	0	0	0.06	0.00
5905-00-184-7703	0.11	199	37	24	21	1	15.18	0.11
5905-00-190-3889	0.07	4	0	0	0	0	0.28	0.00
5905-00-195-8473	0.56	41	6	4	1	1	17.36	0.56
5905-00-228-6088	0.08	1193	475	317	27	1	32.08	0.08
5905-00-232-9942	0.40	60	16	11	4	1	13.20	0.40
5905-00-237-3194	1.43	100	1	0	3	0	141.57	0.00
5905-00-243-1450	0.43	46	7	5	1	2	14.62	0.86
5905-00-243-2200	2.18	33	18	12	8	1	6.54	2.18
5905-00-403-3122	0.29	109	43	29	29	1	10.73	0.29
5905-00-403-4096	2.13	32	0	0	1	0	68.16	0.00
5905-00-432-0371	0.47	5	2	1	0	0	0.94	0.00
5905-00-433-6407	3.41	30	0	0	0	0	102.30	0.00
5905-00-439-3580	0.16	6	2	1	0	0	0.48	0.00
5905-00-451-7525	0.12	39	4	3	4	0	9.84	0.00
5905-00-456-3918	5.61	36	0	0	0	0	201.96	0.00
5905-00-461-2213	3.67	25	7	5	1	0	47.71	0.00
5905-00-466-1479	1.18	45	22	15	2	1	9.44	1.18
5905-00-485-4545	0.11	544	263	109	64	1	18.92	0.11
5905-00-495-4940	0.00	44	4	2	2	0	0.00	0.00
5905-00-528-9928	1.00	4	0	0	0	0	4.00	0.00
5905-00-582-1175	1.34	10	2	1	0	0	9.38	0.00
5905-00-681-6462	0.03	32	0	0	0	0	0.96	0.00
5905-00-681-8818	0.30	7	0	0	1	0	2.10	0.00
5905-00-681-9969	0.33	68	0	0	0	0	22.44	0.00
5905-00-682-4098	0.07	651	120	80	9	0	31.57	0.00
5905-00-682-4109	0.08	3	0	0	0	0	0.24	0.00
5905-00-683-2238	0.09	1079	318	212	98	0	49.41	0.00
5905-00-683-2243	0.08	8	2	1	0	0	0.40	0.00

NSN	COST	STOCK	PAQ	FCAST	ACT'L	ORD	COST OF SURPLUS STOCK	COST OF STOCK ORDERED
5905-00-683-7721	0.08	1	0	0	0	0	0.08	0.00
5905-00-683-7723	0.08	4	0	0	1	0	0.32	0.00
5905-00-686-3121	1.57	1	0	0	0	0	1.57	0.00
5905-00-686-3798	0.00	470	75	50	9	0	0.00	0.00
5905-00-686-9994	0.08	19	0	0	0	0	1.52	0.00
5905-00-686-9996	0.08	5	0	0	1	0	0.40	0.00
5905-00-687-0000	0.17	137	0	0	7	0	23.29	0.00
5905-00-691-0195	0.08	3	0	0	0	0	0.24	0.00
5905-00-723-5251	0.08	9	0	0	0	0	0.72	0.00
5905-00-725-3598	0.23	79	0	0	2	0	18.17	0.00
5905-00-726-9758	0.15	48	0	0	0	0	7.20	0.00
5905-00-764-1130	4.20	4	0	0	1	0	16.80	0.00
5905-00-804-0943	0.04	3	1	1	0	0	0.04	0.00
5905-00-838-2515	7.00	7	0	0	1	0	49.00	0.00
5905-00-855-3121	4.25	12	0	0	0	0	51.00	0.00
5905-00-901-8495	0.09	4	0	0	2	0	0.36	0.00
5905-00-905-9355	0.84	13	3	2	0	0	6.72	0.00
5905-00-913-8342	0.99	30	0	0	0	0	29.70	0.00
5905-00-942-9674	0.85	12	3	2	0	0	5.95	0.00
5905-00-982-0214	0.88	88	16	11	3	0	53.68	0.00
5905-00-984-3112	5.65	2	0	0	0	0	11.30	0.00
5905-01-005-1787	0.18	39	25	10	0	0	0.72	0.00
5905-01-005-1788	0.11	87	35	14	0	0	4.18	0.00
5905-01-005-1789	0.16	47	5	2	0	0	6.40	0.00
5905-01-005-1791	0.16	131	50	20	1	0	9.76	0.00
5905-01-007-1300	0.80	11	5	2	1	0	3.20	0.00
5905-01-030-0466	0.30	14	4	3	0	0	2.10	0.00
5905-01-030-0467	3.28	19	9	6	0	0	13.12	0.00
5905-01-039-7466	0.43	20	4	3	0	0	5.59	0.00
5905-01-047-1529	0.15	543	237	158	65	0	22.20	0.00
5905-01-058-7497	2.10	17	0	0	1	2	35.70	4.20
5905-01-077-3757	14.82	13	0	0	0	1	192.66	14.82
5905-01-083-7116	1.00	34	19	8	1	1	7.00	1.00
5905-01-133-6236	0.14	236	135	90	79	0	1.54	0.00
5905-14-040-0366	0.88	213	50	21	0	0	124.96	0.00
5905-14-040-0926	0.88	56	14	6	0	0	31.68	0.00
5905-14-200-2310	1.83	39	19	8	0	1	21.96	1.83
5905-14-220-6912	0.86	4	0	0	0	0	3.44	0.00
5905-14-290-9390	0.29	57	0	0	0	0	16.53	0.00
5905-15-052-1944	0.24	54	7	3	1	1	10.56	0.24
5905-66-021-2925	0.06	2	0	0	0	0	0.12	0.00
5905-66-050-9490	7.18	2	0	0	0	0	14.36	0.00
5905-66-051-2694	1.12	1	0	0	0	0	1.12	0.00
5905-66-052-9478	4.74	31	15	7	0	4	42.66	18.96
5905-66-109-1284	0.08	4	0	0	0	0	0.32	0.00
5905-99-014-0553	0.23	900	38	16	4	0	194.58	0.00
5905-99-021-9032	0.08	18	0	0	0	0	1.44	0.00
5905-99-021-9041	0.14	10	4	2	0	0	0.56	0.00

NSN	COST	STOCK	PAQ	FCAST	ACT'L	ORD	COST OF SURPLUS STOCK	COST OF STOCK ORDERED
5905-99-021-9095	0.21	20	4	2	0	0	2.94	0.00
5905-99-022-1162	0.09	6	0	0	0	0	0.54	0.00
5905-99-022-2128	0.23	54	9	4	2	0	9.43	0.00
5905-99-022-2191	0.54	19	12	5	0	0	1.08	0.00
5905-99-022-3181	0.08	273	60	25	0	0	15.04	0.00
5910-00-007-2003	1.04	552	295	197	66	2	62.40	2.08
5910-00-050-4539	0.52	8	0	0	0	0	4.16	0.00
5910-00-063-8428	0.06	180	13	9	1	1	9.48	0.06
5910-00-078-7227	0.84	62	0	0	3	0	52.08	0.00
5910-00-104-5849	0.47	72	3	2	0	1	31.49	0.47
5910-00-106-7161	2.90	8	0	0	1	0	23.20	0.00
5910-00-108-4300	2.01	40	10	5	[illegible]	[illegible]	[illegible]	[illegible]
5910-00-113-5475	0.92	505	294	193	205	4	16.56	3.68
5910-00-113-5499	0.30	1276	321	206	247	0	224.70	0.00
5910-00-113-9628	153.61	100	58	39	13	3	460.83	460.83
5910-00-113-9817	8.24	413	213	142	20	1	477.92	8.24
5910-00-116-8935	0.55	101	18	12	6	1	39.05	0.55
5910-00-117-8167	1.58	55	15	10	5	2	47.40	3.16
5910-00-117-8170	0.49	108	13	9	2	1	42.14	0.49
5910-00-124-0045	0.45	133	2	1	0	0	53.50	0.00
5910-00-127-1533	5.50	26	4	3	1	1	104.50	5.50
5910-00-132-2712	0.34	54	27	18	11	0	3.06	0.00
5910-00-142-2563	4.24	42	6	6	2	2	127.20	8.48
5910-00-142-6950	9.42	93	34	23	23	1	339.12	9.42
5910-00-182-8389	2.68	3	1	1	1	1	2.68	2.68
5910-00-204-0106	0.36	11	0	0	4	0	3.96	0.00
5910-00-208-4282	0.33	265	59	60	2	45	48.18	14.85
5910-00-236-8740	1.22	602	324	216	25	5	75.64	6.10
5910-00-247-2205	2.21	43	25	17	12	2	2.21	4.42
5910-00-257-1146	0.90	10	0	0	0	0	9.00	0.00
5910-00-402-1640	1.23	38	10	7	0	0	25.83	0.00
5910-00-402-3701	3.73	9	1	1	0	0	26.11	0.00
5910-00-409-0224	2.12	1	0	0	0	0	2.12	0.00
5910-00-417-0830	5.00	5	1	1	0	0	15.00	0.00
5910-00-436-3633	0.73	139	66	44	1	0	20.44	0.00
5910-00-439-5630	1.93	9	0	[illegible]	[illegible]	0	[illegible]	[illegible]
5910-00-450-8592	0.34	30	10	4	2	0	5.44	0.00
5910-00-451-1372	0.71	23	14	6	5	2	2.13	1.42
5910-00-462-6881	3.22	14	0	0	0	2	45.08	6.44
5910-00-469-5602	0.93	15	5	0	1	2	9.30	1.86
5910-00-521-2410	0.13	5	1	1	0	0	0.39	0.00
5910-00-600-6889	0.35	3	0	0	2	[illegible]	6.30	0.00
5910-00-688-6457	0.78	526	114	76	11	7	362.08	5.46
5910-00-780-8216	2.14	44	2	0	[illegible]	0	[illegible]	0.00
5910-00-783-9403	0.37	248	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5910-00-792-8165	0.34	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5910-00-807-7253	1.08	[illegible]	[illegible]	[illegible]	[illegible]	0	[illegible]	0.00
5910-00-824-8236	0.24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

NSN	COST	STOCK	PAQ	FCAST	ACT'L	ORD	COST OF SURPLUS STOCK	COST OF STOCK ORDERED
5910-00-840-3442	8.08	5	2	1	0	0	16.16	0.00
5910-00-840-7794	0.87	26	14	6	7	0	5.22	0.00
5910-00-850-0830	1.28	90	9	6	5	0	96.00	0.00
5910-00-850-5355	1.92	25	0	0	0	0	48.00	0.00
5910-00-854-3117	0.09	76	7	5	8	1	5.76	0.09
5910-00-861-5108	0.67	3	0	0	2	0	2.01	0.00
5910-00-879-3559	0.63	13	0	0	3	0	3.19	0.00
5910-00-880-5430	0.43	456	0	0	0	0	196.08	0.00
5910-00-883-8518	0.56	30	0	0	0	0	16.80	0.00
5910-00-890-4737	0.30	137	12	3	1	1	35.10	0.30
5910-00-928-7504	3.67	25	9	6	0	0	36.70	0.00
5910-00-939-4167	1.59	209	25	17	1	5	[illegible]	[illegible]
5910-00-958-1767	0.91	6	0	0	0	0	5.46	0.00
5910-00-989-9695	0.64	155	0	0	0	0	99.20	0.00
5910-00-995-0614	1.92	53	18	14	0	11	40.32	21.12
5910-01-006-9790	0.50	57	6	4	2	1	25.50	0.50
5910-01-011-6105	0.72	13	2	2	1	14	6.48	10.08
5910-01-030-1101	0.35	20	10	4	1	3	2.10	1.05
5910-01-033-0425	1.54	49	12	3	10	2	44.66	3.08
5910-01-044-3584	2.12	20	9	6	2	1	10.60	2.12
5910-01-047-8498	1.19	11	0	0	0	0	13.09	0.00
5910-01-048-9183	2.52	33	14	6	2	1	32.76	2.52
5910-01-049-4960	1.95	30	10	7	2	1	25.35	1.95
5910-01-049-5675	0.19	90	13	12	1	1	11.40	0.19
5910-01-060-7678	0.35	7	1	2	1	0	1.40	0.00
5910-01-062-4802	3.44	15	1	1	0	3	44.72	10.32
5910-01-066-4956	7.43	29	1	1	1	1	200.61	7.43
5910-01-081-4675	20.57	77	30	12	3	2	719.35	41.14
5910-01-085-8358	0.75	13	6	2	0	0	3.75	0.00
5910-01-092-1589	0.31	15	7	3	0	0	1.55	0.00
5910-01-113-2894	23.27	5	0	0	0	1	116.35	23.27
5910-14-258-9822	2.33	101	2	1	0	0	228.34	0.00
5910-66-052-9855	7.35	22	0	1	0	1	154.35	7.35
5910-66-052-9856	1.44	55	4	2	1	1	70.56	1.44
5910-66-053-0623	1.87	46	0	0	1	0	86.02	0.00
5910-66-109-0498	0.99	92	0	[illegible]	1	0	91.08	0.00
5910-99-953-0515	0.83	109	0	0	0	0	90.47	0.00
5915-01-012-6264	72.34	11	3	2	1	1	434.04	72.34
5930-00-543-1237	2.28	41	13	9	0	1	43.32	2.28
5935-00-192-4729	1.04	71	31	20	15	1	20.80	1.04
5935-00-492-7742	10.87	26	7	5	2	1	152.18	10.87
5935-00-493-0431	2.08	14	5	4	2	1	10.40	2.08
5935-00-615-8555	0.31	1087	30	19	0	1	321.78	0.31
5935-00-752-2974	0.14	1293	74	48	53	0	163.94	0.00
5935-01-073-4633	39.71	7	2	1	1	1	158.84	39.71
5940-00-110-2993	0.19	193	90	60	0	14	8.17	[illegible]
5940-00-259-5743	0.19	606	0	0	0	3	115.14	0.57
5940-00-644-8722	0.14	7444	94	63	20	1	[illegible]	[illegible]

NSN	COST	STOCK	PAQ	FCAST	ACT'L	ORD	COST OF SURPLUS STOCK	COST OF STOCK ORDERED
5940-00-761-3327	0.17	89	39	26	0	19	4.08	3.23
5940-00-763-1228	0.02	20	10	7	0	0	0.06	0.00
5940-00-882-2782	0.33	87	12	5	0	0	23.10	0.00
5940-00-904-9633	0.05	764	184	123	0	1	22.85	0.05
5940-00-910-3544	0.43	117	67	45	0	75	2.15	32.25
5940-00-935-3379	0.16	257	84	56	2	6	18.72	0.96
5940-01-013-0805	0.29	20	4	3	0	2	3.77	0.58
5950-00-042-4694	1.56	8	0	0	0	1	12.48	1.56
5950-00-279-6539	0.50	37	16	11	1	1	5.00	0.50
5950-00-325-6470	0.50	11	6	4	0	1	0.50	0.50
5950-00-503-8700	0.73	103	12	8	1	2	60.59	1.46
5950-00-734-3940	0.67	122	34	23	3	0	43.55	0.00
5950-00-779-3452	0.27	372	104	42	46	1	61.02	0.27
5950-00-875-4597	5.55	6	0	0	0	1	33.30	5.55
5950-00-957-0712	0.22	12	0	0	0	1	2.64	0.22
5950-00-961-3599	0.46	57	0	0	0	0	26.22	0.00
5950-01-003-4885	1.54	13	1	1	0	1	16.94	1.54
5950-01-004-9024	0.71	41	4	3	1	1	24.14	0.71
5950-01-029-8026	0.84	9	3	3	1	1	2.52	0.84
5950-01-030-4046	0.49	18	7	3	0	2	3.92	0.98
5950-01-030-6749	2.19	11	7	3	1	2	2.19	4.38
5950-01-030-8409	0.36	23	7	5	0	6	3.96	2.16
5950-01-031-0250	2.38	18	7	3	0	1	19.04	2.38
5950-01-031-4509	6.23	15	4	3	0	1	49.84	6.23
5950-01-031-4643	1.48	22	6	4	1	3	17.76	4.44
5950-66-052-9476	16.63	11	7	3	1	2	16.63	33.26
5950-66-097-2503	0.61	168	0	0	0	14	102.48	8.54
5955-01-081-6236	28.71	15	7	3	1	1	143.55	28.71
5961-00-022-5666	1.27	1743	1136	468	496	6	176.53	7.62
5961-00-069-3641	0.41	231	72	48	39	1	45.51	0.41
5961-00-083-3297	0.15	344	222	92	86	1	4.50	0.15
5961-00-115-3450	1.07	1075	87	58	14	5	995.10	5.35
5961-00-124-5019	0.76	299	66	44	22	3	143.64	2.28
5961-00-185-3559	11.09	59	15	15	16	1	321.61	11.09
5961-00-226-3579	0.44	365	159	106	85	3	44.00	1.32
5961-00-241-3532	2.25	295	14	14	4	1	600.75	2.25
5961-00-420-3668	1.00	729	317	204	114	2	208.00	2.00
5961-00-487-2825	0.74	18	7	5	4	1	4.44	0.74
5961-00-603-8935	4.13	23	4	3	2	1	66.08	4.13
5961-00-731-9831	0.20	204	55	37	2	18	22.40	3.60
5961-00-732-5028	0.25	194	78	52	5	10	16.00	2.50
5961-00-833-2016	0.38	8	3	2	1	9	1.14	3.42
5961-00-836-6663	0.98	678	246	158	161	2	268.52	1.96
5961-00-847-5242	0.41	53	11	7	7	1	14.35	0.41
5961-00-847-5247	0.30	283	52	35	21	1	58.80	0.30
5961-00-938-4977	3.12	384	190	127	33	1	209.04	3.12
5961-01-013-0831	9.48	5	0	0	0	1	47.40	9.48
5961-01-016-1936	12.12	38	22	15	2	1	12.12	12.12

NSN	COST	STOCK	PAQ	FCAST	ACT'L	ORD	COST OF SURPLUS STOCK	COST OF STOCK ORDERED
5961-01-030-1237	72.70	89	53	22	6	1	1017.80	72.70
5961-01-041-3344	3.61	52	12	8	4	0	115.52	0.00
5961-01-043-7003	0.54	5	0	0	0	4	2.70	2.16
5961-01-043-7004	0.38	10	0	0	0	7	3.80	2.66
5961-01-043-9178	0.47	195	82	55	3	30	27.26	14.10
5961-01-067-7294	4.95	57	19	13	7	0	123.75	0.00
5961-01-082-8807	2.23	322	88	59	53	1	390.25	2.23
5961-14-254-6362	1.06	156	119	0	21	27	39.22	28.62
5961-66-052-9868	8.25	11	0	0	0	0	90.75	0.00
5962-00-318-2223	1.96	6965	2943	1962	226	5	4037.60	9.80
5962-00-318-2224	2.30	2837	829	55	95	0	4491.90	0.00
5962-00-341-0544	1.56	3601	433	289	108	0	4491.24	0.00
5962-00-348-2541	2.25	593	362	161	109	2	157.50	4.50
5962-00-361-8649	2.55	1042	93	62	20	1	2261.85	2.55
5962-00-365-5728	1.31	402	154	103	30	2	189.95	2.62
5962-00-390-5170	0.62	24	0	0	1	0	14.88	0.00
5962-00-432-0989	15.82	40	0	0	0	0	632.80	0.00
5962-00-503-8069	0.82	9	4	3	0	0	1.64	0.00
5962-01-030-6127	7.41	14	7	5	1	1	14.82	7.41
5962-01-030-6796	69.45	21	5	2	0	1	972.30	69.45
5962-01-031-4528	1.38	11	3	4	0	2	5.52	2.76
5962-01-076-8391	5.59	25	11	5	0	0	50.31	0.00
5962-01-082-4487	34.53	29	7	5	4	1	587.01	34.53
5970-00-246-4898	0.05	853	4	0	10	4	42.45	0.20
5970-00-910-3528	0.01	49	24	16	0	2	0.09	0.02
5975-00-825-3330	4.38	12	7	4	4	4	4.38	17.52
5975-01-124-7394	0.81	5	0	0	0	2	4.05	1.62
5999-00-137-1134	0.73	225	6	4	8	1	156.95	0.73
5999-00-410-5450	0.28	3357	49	33	5	4	917.00	1.12
5999-00-424-9736	0.11	85	22	15	3	13	5.28	1.43
5999-01-030-3933	2.79	21	9	4	0	1	22.32	2.79
5999-01-105-4991	0.56	43	18	12	0	2	7.28	1.12
5999-66-057-3446	0.49	50	2	0	0	1	23.52	0.49
6210-00-881-1507	0.74	89	13	9	0	1	49.58	0.74
6240-00-155-7336	0.41	160	0	0	25	0	65.60	0.00
*** Total ***								
	2229.41	131732	32761	18130	9039	883	63079.63	1736.31

Appendix C: Unique Spare Parts

NSN	COST	STOCK	PAQ	FCAST	ACT'L	ORD	TOTAL COST OF STOCK	TOTAL COST OF ORDER
3120-01-114-8837	1.74	5	0	0	0	4	8.70	6.96
4730-01-116-0433	1.37	0	0	0	0	5	0.00	6.85
5305-01-026-4957	0.00	0	0	1	0	5	0.00	0.00
5305-01-026-4962	0.00	0	0	1	0	4	0.00	0.00
5305-01-110-2728	0.63	100	0	1	0	10	63.00	6.30
5305-01-116-0850	1.74	5	0	0	0	1	8.70	1.74
5310-01-030-8411	0.15	10	0	0	0	2	1.50	0.30
5340-01-114-6792	2.68	5	0	0	0	4	13.40	10.72
5365-01-116-0616	2.90	5	0	0	0	4	14.50	11.60
5365-01-116-1043	1.63	0	0	0	0	5	0.00	8.15
5365-01-116-1044	1.63	0	0	0	0	2	0.00	3.26
5905-01-114-9162	6.64	5	0	0	0	1	33.20	6.64
5910-00-022-8185	7.81	7	3	0	0	1	54.67	7.81
5910-00-029-4852	2.87	7	0	0	1	1	20.09	2.87
5910-00-481-8316	0.00	0	0	0	1	3	0.00	0.00
5910-00-877-8189	0.29	0	0	0	0	2	0.00	0.58
5910-01-006-7205	2.29	5	0	0	0	1	11.45	2.29
5910-01-030-4026	5.77	27	1	1	1	1	155.79	5.77
5910-01-114-4239	0.00	0	0	0	0	2	0.00	0.00
5910-01-115-1951	0.00	0	0	0	0	1	0.00	0.00
5910-01-133-3896	4.22	10	2	1	0	1	42.20	4.22
5935-01-087-6384	0.29	0	0	0	0	12	0.00	3.48
5935-01-108-0076	0.33	0	0	0	0	8	0.00	2.64
5935-01-126-5930	0.00	0	0	1	0	1	0.00	0.00
5935-01-147-5904	0.89	100	0	0	0	1	89.00	0.89
5945-00-138-7761	24.19	3	0	0	0	2	72.57	48.38
5945-01-125-5281	20.99	0	0	0	0	1	0.00	20.99
5945-01-127-9293	101.47	4	0	0	0	1	405.88	101.47
5950-00-498-1908	0.20	5	0	0	0	1	1.00	0.20
5950-00-576-5143	0.67	48	2	1	0	1	32.16	0.67
5950-01-118-9225	0.00	0	0	1	0	1	0.00	0.00
5950-01-127-9249	0.00	0	0	1	0	3	0.00	0.00
5950-01-153-0633	6.53	5	0	0	0	3	32.65	19.59
5961-00-520-5175	19.53	3	1	1	2	3	58.59	58.59
5999-01-083-7344	0.00	0	0	1	0	0	0.00	0.00
5999-01-110-2998	22.15	5	0	0	0	2	110.75	44.30
5999-01-114-6313	0.00	0	0	0	0	1	0.00	0.00
5999-01-115-1899	0.00	4	4	0	0	0	0.00	0.00
*** Total ***								
	241.60	363	13	11	5	101	1229.30	337.26

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Squadron Leader Geoffrey E. Tasker was born on 5 June 1954 in Perth, Western Australia. On graduation from high school in 1971, he then entered the Royal Australian Air Force Academy. While at the Academy he received his Bachelor of Science degree and a post Graduate Diploma in Military Aviation. On graduation he received his commission to the Royal Australian Air Force and commenced pilots course in 1976. Since receiving his wings he has flown Iroquois and Chinook helicopters with numbers 9 and 12 Squadrons, and Caribou transport aircraft with number 38 Squadron RAAF. The two other positions held were as the Rotary Wing Project Officer at Air Movements Training and Development Unit, and most recently as an instructor at the RAAF Officer Training School. From this last unit he then entered the School of Systems and Logistics, United States Air Force Institute of Technology, in June 1986.

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The purpose of this study was to determine if worthwhile cost savings could be obtained by the Royal Australian Air Force by considering commonality of piece part components during the acquisition of a new aircraft avionics system. The study had two basic objectives:
(1) Determine if common component procurement could be reduced during a new system acquisition, and thus provide cost savings for the RAAF. (2) Determine a method that would allow a comparison to be made, between the savings gained and aircraft availability lost, as a result of not procuring unique components associated with the new system.

The study found that considerable immediate and long term cost savings could be obtained if the procurement policy was changed so that only essential common components were purchased. It was recommended that common components be purchased coincident with the new system only when the subsequent demand rate would exceed the inventory holdings.

A simple mathematical model was developed in this study that allows the determination of the effect of not procuring unique components on aircraft operational availability. The study recommends that future procurements use this model and then, on an individual project or system basis, compare the potential cost savings with the expected reduction in aircraft availability to determine the level or number of unique components procured with the new system.

END

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